

【CLAIMS】

【Claim 1】 A bake-hardenable cold rolled steel sheet having excellent formability, comprising: 0.003 ~ 0.005 % of C; 0.003 ~ 0.03 % of S; 0.01 ~ 0.1 % of Al; 0.02 % or less of N; 0.2 % or less of P; at least one of 0.03 ~ 0.2 % of Mn and 0.005 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, in terms of weight%, wherein, when the steel sheet comprises one of Mn and Cu, a composition of Mn, Cu, and S satisfies one of relationships: $0.58 \cdot \text{Mn}/\text{S} \leq 10$ and $1 \leq 0.5 \cdot \text{Cu}/\text{S} \leq 10$, and when the steel sheet comprises both Mn and Cu, a composition of Mn, Cu, and S satisfies the relationships: $\text{Mn} + \text{Cu} \leq 0.3$ and $2 \leq 0.5 \cdot (\text{Mn} + \text{Cu})/\text{S} \leq 20$, and wherein precipitates of MnS, CuS, and (Mn, Cu)S have an average size of 0.2 μm or less.

【Claim 2】 A bake-hardenable cold rolled steel sheet having excellent formability, comprising: 0.003 ~ 0.005 % of C; 0.005 ~ 0.03 % of S; 0.01 ~ 0.1 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.05 ~ 0.2 % of Mn; and the balance of Fe and other unavoidable impurities, in terms of weight%, wherein a composition of Mn and S satisfies the relationship: $0.58 \cdot \text{Mn}/\text{S} \leq 10$ in terms of weight, and wherein precipitates of MnS have an average size of 0.2 μm or less.

【Claim 3】 The steel sheet as set forth in claim 2, wherein the steel sheet comprises 0.015 % or less of P.

【Claim 4】 The steel sheet as set forth in claim 2, wherein the steel sheet comprises 0.004 % or less of N.

【Claim 5】 The steel sheet as set forth in claim 2, wherein the steel sheet comprises 0.03 ~ 0.2 % of P.

【Claim 6】 The steel sheet as set forth in claim 2, wherein the steel sheet further comprises at least one of 0.1 ~ 0.8 % of Si, and 0.2 ~ 1.2 % of Cr.

【Claim 7】 The steel sheet as set forth in claim 2, wherein the steel sheet comprises

0.005 ~ 0.02 % of N, and 0.03 ~ 0.06 % of P.

【Claim 8】 The steel sheet as set forth in claim 7, wherein a composition of Al and N satisfies the relationship: $1 \leq 0.52 \cdot \text{Al}/\text{N} \leq 5$.

5 【Claim 9】 The steel sheet as set forth in any one of claims 2 to 8, wherein the steel sheet further comprises 0.01 ~ 0.2 % of Mo.

10 【Claim 10】 A bake-hardenable cold rolled steel sheet having excellent formability, comprising: 0.003 ~ 0.005 % of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.01 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, in terms of weight%, wherein a composition of Cu and S satisfies the relationship: $1 \leq 0.5 \cdot \text{Cu}/\text{S} \leq 10$ in terms of weight, and wherein precipitates of CuS have an average size of 0.1 μm or less.

【Claim 11】 The steel sheet as set forth in claim 10, wherein the steel sheet comprises 0.015 % or less of P.

15 【Claim 12】 The steel sheet as set forth in claim 10, wherein the steel sheet comprises 0.004 % or less of N.

【Claim 13】 The steel sheet as set forth in claim 10, wherein the composition of Cu and S satisfies the relationship: $1 \leq 0.5 \cdot \text{Cu}/\text{S} \leq 3$.

【Claim 14】 The steel sheet as set forth in claim 10, wherein the steel sheet comprises 0.03 ~ 0.2 % of P.

20 【Claim 15】 The steel sheet as set forth in claim 10, wherein the steel sheet further comprises at least one of 0.1 ~ 0.8 % of Si, and 0.2 ~ 1.2 % of Cr.

【Claim 16】 The steel sheet as set forth in claim 10, wherein the steel sheet comprises 0.005 ~ 0.02 % of N, and 0.03 ~ 0.06 % of P.

【Claim 17】 The steel sheet as set forth in claim 16, wherein a composition of Al and N satisfies the relationship: $1 \leq 0.52 \cdot \text{Al}/\text{N} \leq 5$.

【Claim 18】 The steel sheet as set forth in any one of claims 10 to 17, wherein the steel sheet further comprises 0.01 ~ 0.2 % of Mo.

5 【Claim 19】 A bake-hardenable cold rolled steel sheet having excellent formability, comprising: 0.003 ~ 0.005 % of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.03 ~ 0.2 % of Mn; 0.005 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, in terms of weight%, wherein a composition of Mn, Cu, and S satisfies the relationships: $\text{Mn} + \text{Cu} \leq 0.3$ and $2 \leq 0.5 \cdot (\text{Mn} + \text{Cu})/\text{S} \leq 20$ in
10 terms of weight, and wherein precipitates of MnS, CuS, and (Mn, Cu)S have an average size of 0.2 μm or less.

【Claim 20】 The steel sheet as set forth in claim 19, wherein the steel sheet comprises 0.015 % or less of P.

15 【Claim 21】 The steel sheet as set forth in claim 19, wherein the steel sheet comprises 0.004 % or less of N.

【Claim 22】 The steel sheet as set forth in claim 19, wherein the number of precipitates is 2×10^6 or more per unit area (mm^2).

【Claim 23】 The steel sheet as set forth in claim 19, wherein the composition of Mn, Cu and S satisfies the relationship: $2 \leq 0.5 \cdot (\text{Mn} + \text{Cu})/\text{S} \leq 7$.

20 【Claim 24】 The steel sheet as set forth in claim 23, wherein the number of precipitates is 2×10^8 or more per unit area (mm^2).

【Claim 25】 The steel sheet as set forth in claim 19, wherein the steel sheet comprises 0.03 ~ 0.2 % of P.

【Claim 26】 The steel sheet as set forth in claim 19, wherein the steel sheet further comprises at least one of 0.1 ~ 0.8 % of Si, and 0.2 ~ 1.2 % of Cr.

【Claim 27】 The steel sheet as set forth in claim 19, wherein the steel sheet comprises 0.005 ~ 0.02 % of N, and 0.03 ~ 0.06 % of P.

5 【Claim 28】 The steel sheet as set forth in claim 27, wherein a composition of Al and N satisfies the relationship: $1 \leq 0.52 \cdot \text{Al}/\text{N} \leq 5$.

【Claim 29】 The steel sheet as set forth in any one of claims 19 to 28, wherein the steel sheet further comprises 0.01 ~ 0.2 % of Mo.

10 【Claim 30】 A method of manufacturing a bake-hardenable cold rolled steel sheet having excellent formability, comprising the steps of: hot-rolling a steel slab with finish rolling at an Ar_3 transformation temperature or more to provide a hot rolled steel sheet, after reheating the steel slab to a temperature of 1,100 °C or more, the steel slab comprising comprising: 0.003 ~ 0.005 % of C; 0.005 ~ 0.03 % of S; 0.01 ~ 0.1 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.05 ~ 0.2 % of Mn; and the balance of Fe and
15 other unavoidable impurities, in terms of weight%, wherein a composition of Mn and S satisfies the relationship: $0.58 \cdot \text{Mn}/\text{S} \leq 10$ in terms of weight; cooling the steel sheet at a speed of 200 °C/min or more; winding the cooled steel sheet at a temperature of 700 °C or less; cold rolling the steel sheet; and continuous annealing the cold rolled steel sheet.

20 【Claim 31】 The method as set forth in claim 30, wherein the steel slab comprises 0.015 % or less of P.

【Claim 32】 The method as set forth in claim 30, wherein the steel slab comprises 0.004 % or less of N.

【Claim 33】 The method as set forth in claim 30, wherein the steel slab comprises 0.03 ~ 0.2 % of P.

【Claim 34】 The method as set forth in claim 30, wherein the steel slab further comprises at least one of 0.1 ~ 0.8 % of Si, and 0.2 ~ 1.2 % of Cr.

【Claim 35】 The method as set forth in claim 30, wherein the steel slab comprises 0.005 ~ 0.02 % of N, and 0.03 ~ 0.06 % of P.

5 【Claim 36】 The method as set forth in claim 30, wherein a composition of Al and N satisfies the relationship: $1 \leq 0.52 \cdot \text{Al}/\text{N} \leq 5$.

【Claim 37】 The steel sheet as set forth in any one of claims 30 to 36, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

10 【Claim 38】 A method of manufacturing a bake-hardenable cold rolled steel sheet having excellent formability, comprising the steps of: hot-rolling a steel slab with finish rolling at an A_{r3} transformation temperature or more to provide a hot rolled steel sheet, after reheating the steel slab to a temperature of 1,100 °C or more, the steel slab comprising: 0.003 ~ 0.005 % of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.01 ~ 0.2 % of Cu; and the balance of Fe and other
15 unavoidable impurities, in terms of weight%, wherein a composition of Cu and S satisfies the relationship: $1 \leq 0.5 \cdot \text{Cu}/\text{S} \leq 10$ in terms of weight; cooling the steel sheet at a speed of 300 °C/min or more; winding the cooled steel sheet at a temperature of 700 °C or less; cold rolling the steel sheet; and continuous annealing the cold rolled steel sheet.

20 【Claim 39】 The method as set forth in claim 38, wherein the steel slab comprises 0.015 % or less of P.

【Claim 40】 The method as set forth in claim 38, wherein the steel slab comprises 0.004 % or less of N.

25 【Claim 41】 The method as set forth in claim 38, wherein the composition of Cu and S satisfies the relationship: $1 \leq 0.5 \cdot \text{Cu}/\text{S} \leq 3$.

【Claim 42】 The method as set forth in claim 38, wherein the steel slab comprises 0.03 ~ 0.2 % of P.

【Claim 43】 The method as set forth in claim 38, wherein the steel slab further comprises at least one of 0.1 ~ 0.8 % of Si, and 0.2 ~ 1.2 % of Cr.

5 【Claim 44】 The method as set forth in claim 38, wherein the steel slab comprises 0.005 ~ 0.02 % of N, and 0.03 ~ 0.06 % of P.

【Claim 45】 The method as set forth in claim 38, wherein a composition of Al and N satisfies the relationship: $1 \leq 0.52 * Al/N \leq 5$.

10 【Claim 46】 The method as set forth in any one of claims 38 to 45, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.

15 【Claim 47】 A method of manufacturing a bake-hardenable cold rolled steel sheet having excellent formability, comprising the steps of: hot-rolling a steel slab with finish rolling at an A_{r3} transformation temperature or more to provide a hot rolled steel sheet, after reheating the steel slab to a temperature of 1,100 °C or more, the steel slab comprising: 0.003 ~ 0.005 % of C; 0.003 ~ 0.025 % of S; 0.01 ~ 0.08 % of Al; 0.02 % or less of N; 0.2 % or less of P; 0.03 ~ 0.2 % of Mn; 0.005 ~ 0.2 % of Cu; and the balance of Fe and other unavoidable impurities, in terms of weight%, wherein a composition of Mn, Cu, and S satisfies the relationships: $Mn + Cu \leq 0.3$ and $2 \leq 0.5 * (Mn + Cu) / S \leq 20$ in terms of weight; cooling the steel sheet at a speed of 300 °C/min or more; winding the
20 cooled steel sheet at a temperature of 700 °C or less; cold rolling the steel sheet; and continuous annealing the cold rolled steel sheet.

【Claim 48】 The method as set forth in claim 47, wherein the steel slab comprises 0.015 % or less of P.

25 【Claim 49】 The method as set forth in claim 47, wherein the steel slab comprises 0.004 % or less of N.

【Claim 50】 The method as set forth in claim 47, wherein the number of precipitates is 2×10^6 or more per unit area (mm^2).

【Claim 51】 The method as set forth in claim 47, wherein the composition of Mn, Cu and S satisfies the relationship: $2 \leq 0.5 \cdot (\text{Mn} + \text{Cu}) / \text{S} \leq 7$.

5 【Claim 52】 The method as set forth in claim 51, wherein the number of precipitates is 2×10^8 or more per unit area (mm^2).

【Claim 53】 The method as set forth in claim 47, wherein the steel slab comprises 0.03 ~ 0.2 % of P.

10 【Claim 54】 The method as set forth in claim 47, wherein the steel slab further comprises at least one of 0.1 ~ 0.8 % of Si, and 0.2 ~ 1.2 % of Cr.

【Claim 55】 The method as set forth in claim 47, wherein the steel slab comprises 0.005 ~ 0.02 % of N, and 0.03 ~ 0.06 % of P.

【Claim 56】 The method as set forth in claim 55, wherein a composition of Al and N satisfies the relationship: $1 \leq 0.52 \cdot \text{Al} / \text{N} \leq 5$.

15 【Claim 57】 The method as set forth in any one of claims 47 to 56, wherein the steel slab further comprises 0.01 ~ 0.2 % of Mo.